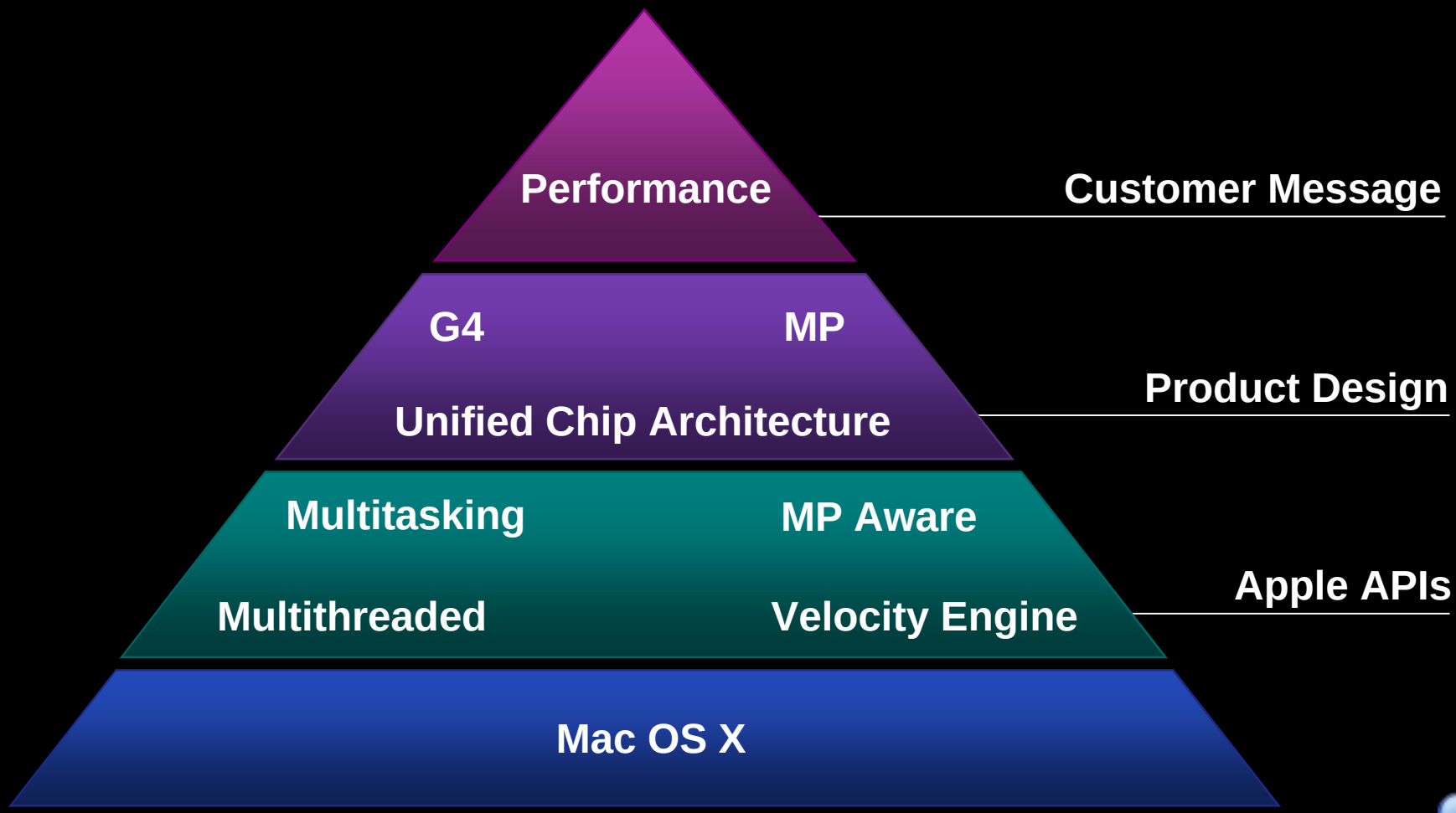
Session 201

How Threading Can Benefit Your Application on Mac OS X

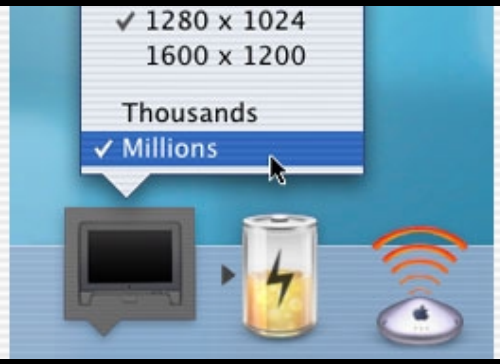
Mark Tozer-Vilchez
Desktop Technology Manager


Performance
Customer Message
G4
MP
Unified Chip Architecture
Product Design
Multitasking
MP Aware
Multithreaded
Velocity Engine
Apple APIs
Mac OS X

Definitions

- Multitasking
  - The ability to handle several different tasks at once
- Multiprocessing
  - The ability of a computer to use more than one processor simultaneously
- Symmetrical Multiprocessing
  - The ability of the OS to schedule code execution among processors

MultiProcessing



Matt Watson
Core OS

Why Threads?

- User perception
- Scalability on MP machines
- Preemption
- Synchronous requests
- No polling

Why Not Threads?

- Added complexity
- Added overhead
- Kernel resources
- Other options (timers)

Thread Overhead

- Thread context switch
- Thread memory footprint
- Thread creation

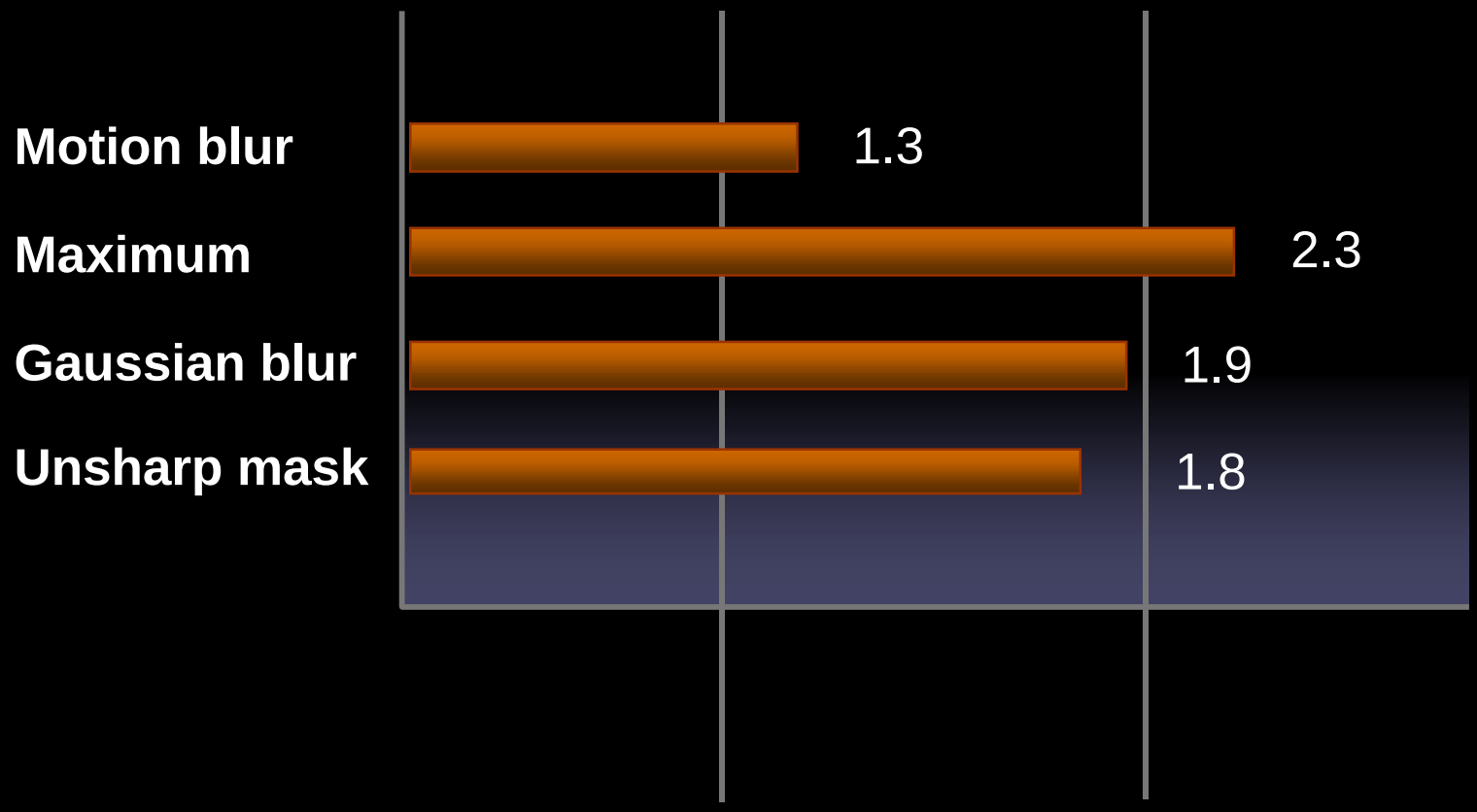
Common Concepts

- How to use threads
  - Thread management
  - Synchronization primitives
- What can be called
  - Thread-safe services

Design

- Threads are the scheduling primitive
- Fully Preemptive
- Priority-based scheduling
- 1–1 model
- Mach threads—look but don’t touch

MP Scaling



Mach

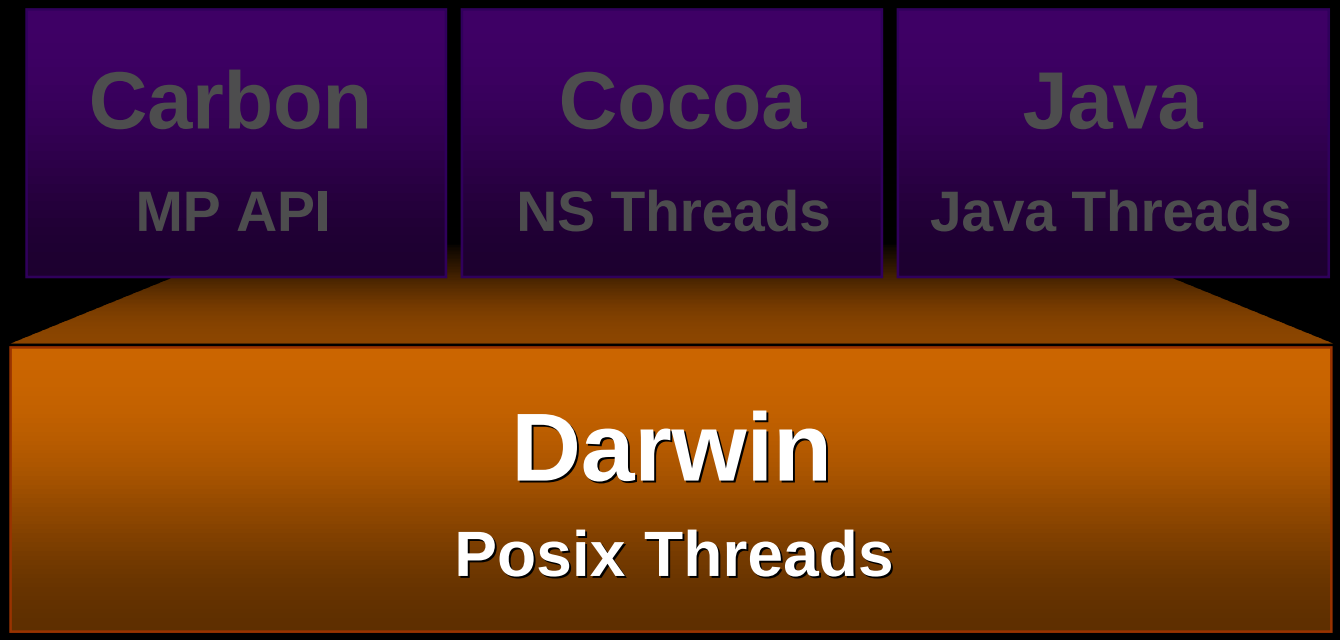
- Full SMP
- Velocity context
- Same kernel binary for UP/MP

Mach Scheduler

- Scheduling framework
- Global run queue
- Signal idle processors
- Preemption

User Frameworks

User Frameworks



pthreads

- Basis for all thread models
- “lite” implementation
- 1–1 Mach-to-pthread
- Common API (mis)uses
- No system-wide types (yet)

pthreads (Cont.)

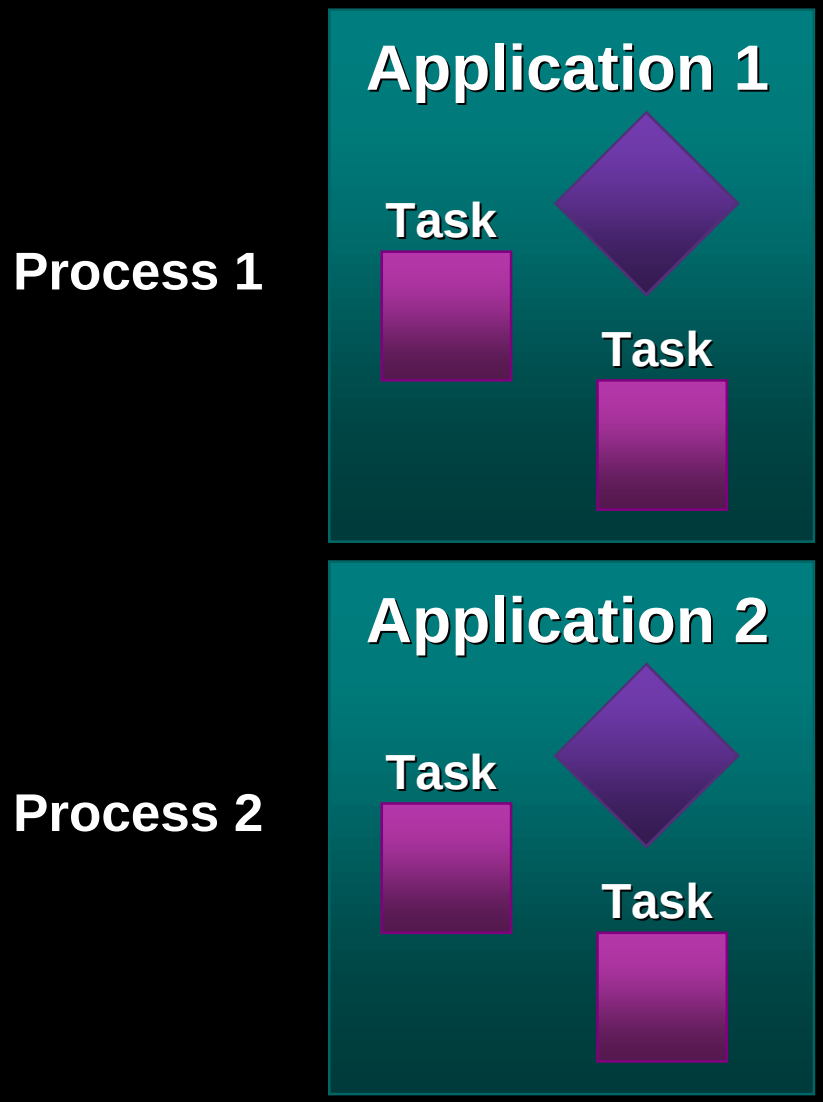
- Synchronization is not cheap
- Don’t forget to detach
- Limit your stack
- Check predicates!
- pthread_cancel()

pthreads Documentation

- http://www.opengroup.org

User Frameworks

MP Tasks



- Address space
- MP tasks are associated with parent task's process
- Separate address spaces

MPTask API

- Several mechanisms exist to coordinate and synchronize tasks
  - Semaphores
  - Message Queues
  - Event Groups
- Critical regions
  - Can handle recursive entries and multiple entry points

MPTask (Cont.)

- Atomic operations
- APIs on Mac OS X
  - Synchronous File Manager
  - Open Transport

http://developer.apple.com/technotes/tn/tn1104.html

MPTask Documentation

http://developer.apple.com/techpubs/mpservices.html

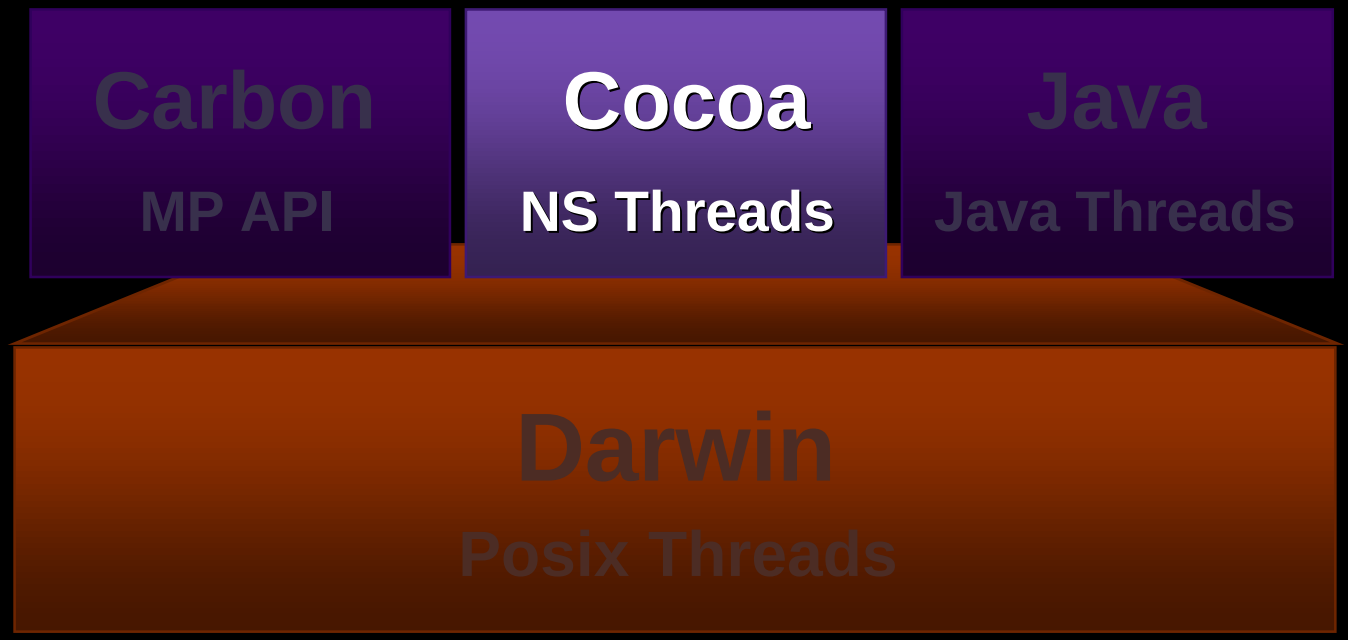
ADC Technology: Technical Documentation: Mac OS 8 and 9

PATH Mac OS 8 and 9 Developer Documentation > Operating System Services > Multiprocessing Services

Multiprocessing Services

Multiprocessing Services provides a programming interface that allows your application to create separate execution threads called tasks. These tasks are preemptively scheduled among the available processors in the system (even if there is only one processor).

User Frameworks



NSThread

- Simple to use
- Always preemptive
- Exit notification
- Per-thread NSDictionary

NSThread (Cont.)

- AppKit extension
- Only self-aware
- Separate run loop
- Autorelease pool

NSThread Documentation

http://developer.apple.com/techpubs/macosx/Cocoa/Reference/Foundation/ObjC_classic/Classes/NSThread.html

ADC Technology: Technical Documentation: Mac OS 8 and 9

PATH Mac OS 8 and 9 Developer Documentation > Operating System Services > Multiprocessing Services

Multiprocessing Services

Multiprocessing Services provides a programming interface that allows your application to create separate execution threads called tasks. These tasks are preemptively scheduled among the available processors in the system (even if there is only one processor).

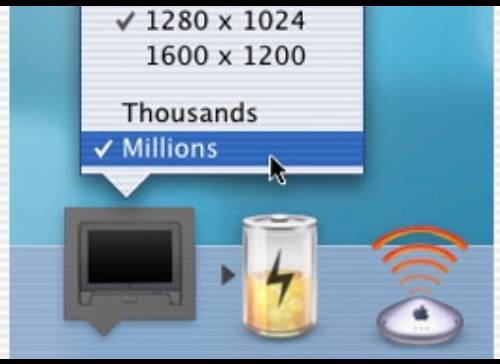
Future Developments

- Priority Inheritance
- API expansion
- Performance
- More thread-safe services

MP Demo (1)

Robert Bowdidge
Developer Tools

MP Demo (2)



Ivan Posva
Java

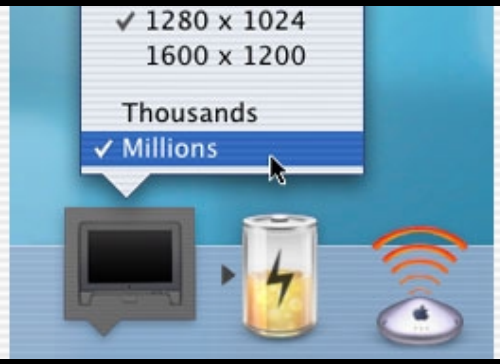
Related Sessions and Resources

121 Carbon Performance Tuning	Hall 2 **Thurs., 2:00 p.m.**
123 Advanced Cocoa Topics	Hall 2 **Thurs., 5:00 p.m.**
140 The Darwin Kernel	Civic **Fri., 3:30 p.m.**

Whom to Contact

Mark Tozer-Vilchez
Desktop Technology Manager
Apple Worldwide Developer Relations
tozer@apple.com

Q&A



Mark Tozer-Vilchez
Desktop Technology Manager
tozer@apple.com

http://developer.apple.com/events/urls.html

WWDC

Worldwide Developers Conference 2001